provide reliable coefficient estimates. Data obtained from real world observations most often contain some random influences, and, in regression analysis, we seldom have the luxury of drawing repeated samples to isolate the signal from the noise in the data. We need to work with real world observations, with all of their peculiarities. When a modeler adds and removes variables to improve the fit to a specific set of data, the peculiarities of the single sample can have an exaggerated impact on the result. The result may be a better "fit" to the specific sample, but there is less confidence that the model provides a good fit outside of the sample predictions. In regression analysis, the data is meant as a test and quantification of hypothesized relationships, not to fit an equation to a specific sample. It is unclear how and where the variation in the dependent variable caused by a deleted variable is attributed to other coefficients. By eliminating "local DEMs" from the model, the FCC further limits that reliability of its models.

Finally, the FCC proposes averaging the results of two different model specifications for toll DEMs. This is inappropriate and serves to demonstrate that the FCC does not have confidence in either of its model specifications.

C. Highly correlated data

After considering the model specification and the key drivers of the dependent variable, the next step in carrying the analysis forward is finding data that are suitable to represent these drivers. The variables considered for the FCC's proposal are switched lines, local dial equipment minutes (DEMs), special access channel equivalents, and toll DEMs.

According to the FCC, the variable for local DEMs was removed because it is highly correlated with switched lines. In the words of the FCC, "the number of switched lines and local DEMs were so highly correlated that it did not increase the explanatory power of the model to include both variables."[17] This is a problem caused by the data, and it is not restricted to the high correlation between switched lines and local usage. Table 10

[17] NPRM at ¶ 219, p. 87.

shows the pair-wise correlation between the variables used to create the FCC's explanatory variables.

Table 10

Correlation Between Variables Used by the FCC to Create Explanatory Variables

	Switched lines	Special lines	Local DEMS	Toll DEMS
Switched lines	1.000			
Special lines	0.901	1.000		
Local DEMS	0.977	0.870	1.000	
Toll DEMS	0.977	0.906	0.922	1.000

A value of 1.000 indicates perfect correlation between two variables, as can be seen in the correlation between each variable and itself. A correlation that is close to one indicates that the variations in two variables are very similar – i.e., variations in one variable are closely matched in directions and relative degree by variations in the other. Table 10 shows very high correlations among any two of the explanatory variables considered by the FCC, including switched lines, special lines, local DEMS and toll DEMS. This means that the variation in any variable that is different from the variations in other variables is very small. This creates the problem that the FCC observed. After the initial explanatory variable is selected, each additional variable contributes little to the explanatory power of the model. This does not mean that variables should be deleted, but it does mean that it is very difficult to separate the causative effects of different variables on expense accounts, and this is a problem that renders the FCC's equations inadequate for the purpose at hand. Peter Kennedy explains the implications of highly correlated explanatory variables as follows:

> When the regressors [explanatory variables] are highly correlated, most of their variation is common to both variables, leaving little variation unique

> to each variable. This means that the OLS procedure has little information to use in making its coefficient estimates, just as though it had a very small sample in which the independent variable did not vary much. Any estimate based on little information cannot be held with much confidence...It is this uncertainty as to which variable deserves the credit for the jointly explained variation in the dependent variable that creates the uncertainty as to the true values of the coefficients being estimated.[18]

With highly correlated explanatory variables, the overall fit of the model can be high and the individual coefficients can even appear significant, but, nonetheless, it is impossible to have confidence in the accuracy of the coefficient estimates. Because the FCC's proposed cost attribution is based on coefficient estimates that are derived from highly correlated data, it is not possible to place the necessary confidence in the accuracy of the results.[19]

Examination of the confidence intervals around the FCC's forecasts reveals the extent of the multicollinearity problem. The first entry of Table 11 shows (for FCC specification 1) that the FCC's unadjusted estimate of the Services expense associated with the local switched access line equals $17.28. Columns 2 and 3 indicate that with 95 percent confidence the true mean of Services expense per switched access line falls between $6.02 and $28.54, a range of plus or minus 65%. The confidence interval for expense associated with special access lines is even wider, extending from -$15.38 to $43.51, a range of plus or minus 209%. The confidence interval for toll DEMS is also substantial. Even though it is not possible to have confidence in the precision of the individual coefficient estimates, the forecast for the overall service expense is reasonably reliable, with an error of within plus or minus 5%. These results demonstrate that the FCC's methodology provides a reasonable forecast for the overall amount of service expense, but it does not provide meaningful estimates of the individual causal relationships between the individual independent variables and service expense. Results for the other accounts follow a similar pattern and are provided in Attachment II.

[18] Kennedy, Peter, *A Guide to Econometrics*. The MIT Press. Cambridge, Massachusetts. 1992. P. 178.

Table 11

Forecast Confidence Intervals for Services Expense (Acct. 6620)

Using FCC's Regression

	FCC Regression Forecast	Confidence Interval Lower 95%	Upper 95%	Forecast Error %
Expense Assoc. with Switched Access Line	$17.28	$6.02	$28.54	+/- 65%
Expense Assoc. with Special Access Line	$14.06	-$15.38	$43.51	+/- 209%
Weighted Average Access Line Expense	$16.86	$7.26	$26.47	+/- 57%
Expense Assoc. with Toll	$28.26	$18.69	$37.82	+/- 34%
Total Expense	$45.12	$42.75	$47.49	+/- 5%

To provide an alternative more intuitive demonstration of the instability of the FCC's regression results, we created an experiment. In this experiment we used a random process to split the 91 observations used by the FCC into two data sets. We repeated this process five times for each expense account and reran the FCC's first regression equation for each sub-set of the data. Wide swings in the estimated coefficients illustrate the instability in the FCC's estimated coefficients. (See Table 12.) Again, we show the results for the "service expense" (account 6620) to illustrate the relationships in the relevant data. Results for the other accounts show a similar pattern. (See Attachments III and IV.)

To assure ourselves that the instability in the regression coefficients was not the result of the split samples being too small, we examined the consistency of means of each of the

[19] In the FCC's proposed regressions, new variables are created by dividing switched lines, special "lines," and toll DEMs by total lines. The correlation between the variables created from switched lines and DEM variables are much less, but the high correlations in the underlying data continue to plague the regressions.

variables used in the split samples. As shown in Table 13, the mean expense per total line, switched access lines per total line, special access lines per total line and toll DEMS per total line are remarkably stable across samples and across runs, considering the instability of regressions coefficients. The average values in the two samples are, therefore very similar, but the coefficients estimated from the two sets of data are very different. This supports the hypothesis that the source of the instability on the individual coefficients is the high degree of collinearity among explanatory variables. With this level of instability in the coefficient estimates it is impossible to have any confidence in the precision of the FCC's division of expenses between supported and non-supported services.

Table 12

Expense Regression Coefficients Using Split Samples (A and B) for Services (Acct. 6620)

	Coefficient of Switched Line *(Full Sample Coeff. = $17.28)*		Coefficient of Special Line *(Full Sample Coeff. = $14.06)*		Coefficient of Toll MOU *(Full Sample Coeff. = $0.0063)*	
Run #	Sample A	Sample B	Sample A	Sample B	Sample A	Sample B
1	$18.72	$15.18	$6.88	$15.49	$0.0066	$0.0063
2	-$1.62	$25.45	-$1.80	$15.06	$0.0109	$0.0044
3	$4.82	$26.83	-$3.95	$25.21	$0.0094	$0.0042
4	$25.09	$15.76	$37.04	-$7.62	$0.0042	$0.0070
5	$18.68	$15.20	$28.49	-$0.15	$0.0057	$0.0071

Table 13

Variable Means for Split Samples (A and B)
for Services (Acct. 6620)

	Expense/Total Lines (Full Sample Mean = $45.22)		Sw. Lines/Total Lines (Full Sample Mean = $0.90)		Sp. Lines/Total Lines (Full Sample Mean = $0.10)		Toll MOU/Total Lines (Full Sample Mean = $4,474)	
Run #	Sample A	Sample B	Sample A	Sample B	Sample A	Sample B	Sample A	Sample B
1	$46.47	$44.00	0.89	0.91	0.11	0.09	4,386	4,560
2	$45.41	$45.03	0.89	0.90	0.11	0.10	4,315	4,629
3	$44.41	$46.01	0.89	0.90	0.11	0.10	4,309	4,635
4	$44.88	$45.55	0.89	0.91	0.11	0.09	4,398	4,548
5	$44.70	$45.73	0.90	0.90	0.10	0.10	4,399	4,548

D. Other data issues

Another difficulty with the expense data stems from the fact that approximately only twenty local exchange companies account for the 91 observations in the sample. The problem is that the parent companies generally assign a significant portion of non-plant specific and customer operations expenses across their operating companies on the basis of an allocation mechanism. As a result, a simple regression on the 91 observations will produce coefficients that reflect a blend of two relationships: 1) the cost causal relationship, and 2) the allocation-based relationship, of which only the former is appropriate to measure. To net out the latter, it is necessary to either model the allocation method explicitly or, more practically, to aggregate the data to the parent company level. Of course, aggregation of the data would result in a much smaller, albeit truer, data set (20 observations). Furthermore, the consolidated data set does not remedy the multicollinearity problem.

E. After model adjustments

There are numerous after regression adjustments proposed by the FCC to eliminate costs from the cost allocated to switched lines by the faulty regression analysis. Some of these adjustments are large and at least one adjustment results in a double elimination of costs related to special access and toll services. For marketing, the FCC proposes an after model adjustment that eliminates 95.6 percent of the expense that it associates with switched lines. This reduction is based on a study by ETI that estimates that residential marketing expenses are only 4.4 percent of *all* marketing expenses. This adjustment all but overwhelms the regression results, and it is applied incorrectly. With its regression, the FCC eliminates marketing expenses that it estimates are caused by special access and toll services. It appears that the ETI based reduction of 95.6 percent is meant to eliminate some of these same expenses. To the extent that there is overlap between the marketing expense eliminated by the FCC's regressions and the marketing expenses eliminated by the ETI study, the FCC proposes to remove these expenses twice. This is what is known as double counting, or in this case double eliminating. Another problem with using the ETI result for isolating marketing expense that is relevant for universal service is that the ETI result does not provide for marketing expense to single-line business customers.

IV. Conclusions

For over two years, regulatory proceedings across the country have focused on structures of total service long run incremental cost (TSLRIC) models and values for key model inputs. This process has framed the debate over the estimation and reasonableness of values for key model inputs. Into this process, the FCC is now proposing an alternative methodology for estimating input values for cable costs, placement costs, and several categories of non-plant specific expenses. If carefully considered, properly implemented, and clearly communicated, the FCC's proposed regression methodology has the potential of making positive contributions to the debate over the values for key model inputs. Unfortunately, the FCC's analysis is not carefully considered, properly implemented, or clearly communicated.

The cable cost regressions are based on previous analysis by Gabel and Kennedy, but the FCC altered the Gabel and Kennedy analysis to make the model specifications inconsistent and the implementation of the results incorrect. The FCC also abandoned the mainstream OLS regression technique for a technique that has consistently reduced the cost estimates. This downward adjustment is most pronounced in the estimation of buried placement costs. Given the effects of this change in methodology, it is incumbent upon the FCC to carry out a more thorough investigation of the data before resorting to a robust estimator.

Even more egregious is the FCC's fatally flawed methodology for extrapolating placement cost estimates for density zones three through nine. This methodology begins with a cost estimate in density zone two that is below the values from HAI and U S WEST proposed input for the BCPM, is based on nationwide BCPM default values that were disavowed by supporters of this model, and uses information that is, by definition, incorrect. The debate over placement costs, formed over the past two years, requires careful consideration of the facts, not an ad hoc methodology that sidesteps the difficult issues. By sidestepping the difficult issues the FCC's proposed methodology and results detract from the meaningful debate over values for this important model input.

The same can be said for the FCC's proposed regression methodology for assigning expenses to supported services. It is very difficult to assign non-plant specific expenses across services. Rather than further the progress of the debate over the most reasonable assignment of expenses, the FCC's proposed methodology sidesteps the difficult questions with a poorly considered and improperly applied methodology. A fatal flaw in the FCC's methodology is that the underlying data for its explanatory variables are so highly collinear that it is not possible to estimate the causal relationships between specific services and expenses. With no confidence in the precision of the estimated coefficients, there can be no confidence is the accuracy of the assignment of expenses to supported services. Without confidence in the assignment, there is no value in the FCC's proposed methodology. As with the other regression analysis proposed by the FCC, the methodology proposed for assigning non-plant specific expenses detract from the search for realistic values for key model inputs.

Attachment I

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PROFESSIONAL EXPERIENCE

Senior Economist ***July 1996 - Present***
Law & Economics Consulting Group
Emeryville, CA

- *Financial modeling and valuation for telecommunications industry clients.* Assess financial and competitive impacts of 1) Telecommunications Act of 1996 and FCC's order to open local exchange markets to competition; 2) regulatory delay of Bell entry into long distance; 3) telecommunications deregulation in Canada. Perform business valuations of entry into wireless (PCS), local exchange, and high capacity service markets.
- *Litigation and Strategic support.* Manage case work and preparation of economic testimony for various telecommunications proceedings, including 1) competitive analyses and public interest assessments of Regional Bell filings for long distance entry; 2) rate proceedings; 3) interconnection arbitration proceedings and cost dockets. Wireless spectrum auction tracking and bidding strategy support.
- *Cost modeling.* Develop, document and critique entry models and clients' cost models. Analyze cost trends.
- *Econometric analysis.* Prepared 1) survival analysis and customer churn model to assess viability of new interactive service; 2) time series demand forecasts of Federal Reserve currency; 3) model of industry price trends to measure damages resulting from alleged price fixing.

Consultant, Graduate Record Examination Board ***June 1995 – June 1998***
Educational Testing Service,
Princeton, NJ

- *Econometric study:* Logistic and survival analysis, using recently collected data from Association of Graduate Schools, to determine factors important in graduate school admissions. Issues include 1) whether factors other than aptitude/achievement, such as gender, ethnicity, and country of citizenship enter into the admissions decision; 2) impact of affirmative action on demand for underrepresented minorities. Published in *Journal of Human Resources.*
- *Follow up study:* Addressed the factors which affect completion of doctoral degree. Issues include extent to which 1) information available at time of admissions forecasts persistence in graduate study; 2) financial assistance influences performance and retention. Forthcoming publication in GRE research journal.

Analyst, Market Analysis and Economics ***June 1995 - June 1996***
AT&T Bell Labs, Business Operations Analysis
Somerset, NJ

- *Computer simulation.* Developed tool to assist regional marketing managers in identifying profitable offer strategies.
- *Quantitative evaluation/forecasting* for acquisition strategy and planning: Identified and countered acquisition strategies of small but fast growing *third tier* long distance competitors.
- *Vulnerability modeling*: Worked with team of analysts to identify the impact of deregulation and entry of resellers into the long distance market in Australia. Designed econometric model to identify customers vulnerable to competitors. Authored internal survey/guide to consumer choice modeling. Internal vulnerability analysis includes modeling to identify AT&T customers likely to switch carriers.
- *Retention analysis:* Projected customer response to promotions.

EDUCATION

Ph.D. , Economics ***1990-1995***
University of Arizona ***Completed in May, 1997***
Tucson, AZ

Dissertation:

- A Theoretical and Experimental Investigation of Volatility Persistence in Financial Markets.
- Fields: Microeconomics, Game Theory, Econometrics. Principal advisor: Vernon Smith.

Teaching:

- Instructor, Intermediate Microeconomics for Business Majors, four semesters.
- Teaching assistant for graduate & undergraduate courses in econometrics, economic principles, intermediate microeconomics.
- Received University of Arizona Foundation's *Outstanding Teaching Award*, 1993.

Research:

- Discrete choice analysis for "Variables Impacting Supply of Minority, Female, and Male Scientists and Engineers." Explained gender and ethnic differences in choice of college major and profession.
- Co-authored "Experiments with the Pivot Process for Providing Public Goods." Tested the practical application of an alternative to contingent valuation methods for eliciting truthful valuations of public goods, for example, to estimate environmental damages. Forthcoming in *Public Choice.*

M.S., Engineering Economics Systems ***June 1989***
Stanford University
Stanford, CA
- Fields: Decision Analysis, Economics.

B.A., Economics ***June 1988***
University of California, Los Angeles
Los Angeles, CA
- Minor in Math and Computer Science.

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EDUCATION

Ph.D., Resource Economics, UNIVERSITY OF MASSACHUSETTS, Amherst, MA, 1986

Emphasis: econometrics, natural resource economics, microeconomics, project evaluation, and industrial organization

M.S., Resource Economics, UNIVERSITY OF MASSACHUSETTS, Amherst, MA, 1981

Emphasis: project evaluation, and economics of forestry

B.S., Economics, STATE UNIVERSITY OF NEW YORK AT STONY BROOK, NY, 1975

PRESENT POSITION

LECG, Emeryville, CA, December 1993 - present
Principal, January 1998 - present
Senior Managing Economist, January 1997 - December 1997
Managing Economist, December 1993 - December 1996

- Construct financial simulation models for the analysis of telecommunications issues, including interconnection policies and competitive entry into the local exchange
- Analyze domestic and international telecommunications issues and provide expert witness testimony for regulatory proceedings and litigation
- Work with telecommunications clients to develop and improve cost models
- Assess impacts to telecommunications firms and competition from uneconomic or unlawful policies and practices

PROFESSIONAL EXPERIENCE

BELLSOUTH CORPORATION, Atlanta, GA, January 1988 - December 1993
Senior Economist, April 1992 - December 1993
Corporate Economist, January 1988 - April 1992

- Applied the tools of economic, financial and quantitative analysis to the identification and solution of a broad range of business problems, and developed recommendations for use by senior management in making policy decisions
- Key role in building model of the telephone company that interconnects behavioral equations for capital spending, expenses, real revenues, regulation, and a production function
- Based on model output, formulated and presented policy recommendations and contingency plans to meet expected changes in BellSouth's business environment, such as more severe competition, alternative regulation, and investment in multimedia
- Assessment of potential impacts of wireless on traditional wireline and cellular services
- Analyzed corporate level impacts of prospective mergers and acquisitions
- Derived econometric model that is used to create capital spending targets for the Telco and explore network investment options
- Analyzed corporation's advertising and publishing business to assist with derivation of a new pricing strategy
- Estimated the financial impacts of proposed permutations of interstate price caps
- Provided financial modeling analysis for the tender and bid process for international investments

AT&T, Bedminster, New Jersey, June 1986 - January 1988
Market Analysis and Forecasting

- Developed econometric forecasting models for telecommunication services; identified direction and financial implications of customer migration among private line services; wrote principal components regression software; presented technical and theoretical papers and seminars

PAPERS FILED WITH REGULATORY AGENCIES

Paper prepared for Telecom New Zealand titled "Review of Network Costing Model Used in Todd Telecommunications Consortium Report," by George Barker, William L. Fitzsimmons, Kieran Murray & Graham Scott dated December 2, 1998

"LECG Financial Simulation Model of Effects of FCC Policies on Large Local Exchange Carriers," by Dr. William Fitzsimmons, Dr. Robert Crandall, Professor Robert G. Harris, and Professor Leonard Waverman, Paper filed with FCC, August 1996

PRESENTATIONS AND REGULATORY PROCEEDINGS

Joint reply affidavit with Debra Aron and Robert G. Harris on behalf of Ameritech in the matter of implementation of the local competition provisions in the Telecommunications Act of 1996 (CC Docket No. 96-98); filed June 10, 1999

Expert affidavit on behalf of Ameritech in the matter of implementation of the local competition provisions in the Telecommunications Act of 1996 (CC Docket No. 96-98); filed May 26, 1999

Expert written testimony and cross-examination on behalf of US West in interconnection arbitration proceedings in 1997

South Dakota (Docket No. TC96-184),

Montana (Docket No. D96.11.200),

Wyoming (Docket Nos. 72000-TS-96-95 and 70000-TS-96-319),

New Mexico (Docket No. 96-411-TC),

North Dakota (Docket No. PU-453-96-497),

Idaho (Docket Nos. USW-T-96-15 and ATT-T-96-2), and

Colorado (Docket No. 96S-331T)

Participated in cost workshops on behalf of US West with the Utah Division of Public Utilities and Minnesota Commission in 1996, 1997, and 1998

Expert written testimony and cross-examination on behalf of US West in consolidated cost dockets in

Arizona (Docket Nos. U-3021-96-448, 1996),

Iowa (Docket No. RPU-96-9, 1997),

New Mexico (Docket Nos. 96-310-TC and 97-334-TC, 1998),

Minnesota (Docket Nos. P-442, 5321, 3167, 466, 421/CI-96-1540, 1998), and

Utah (Docket No. 94-999-01, Phase III, Part C, 1998)

Expert testimony and cross-examination in universal service proceedings on behalf of U S WEST in 1997 and 1998

New Mexico (Docket Nos. 96-310-TC, 97-334-TC),

Minnesota (MPUC Docket No. P-999/M-97-909),

Wyoming (General Order No. 81),

Idaho (Case No. GNR-T-97-22), and

Nebraska (Application No. C-1633)

Expert declarations in support of motions for summary judgment by U S WEST in Iowa (June 1997) and Washington (January 1998)

Presentation on "TELRIC Concepts and Applications," Basics of Regulation Conference, New Mexico State University Center for Public Utilities and the National Association of Regulatory Commissioners, Albuquerque, New Mexico, September 18, 1996

June 1999

Attachment II

Table II.1

Predicted Expense and Confidence Intervals for Marketing (Acct. 6610)

	FCC Regression Forecast	Confidence Interval Lower 95%	Confidence Interval Upper 95%	Forecast Error %
Expense Assoc. with Switched Access Line	$7.19	$1.24	$13.14	+/- 83%
Expense Assoc. with Special Access Line	$37.64	$22.08	$53.21	+/- 41%
Weighted Average Access Line Expense	$11.10	$6.02	$16.18	+/- 46%
Expense Assoc. with Toll	$8.01	$2.95	$13.06	+/- 63%
Total Expense	$19.10	$17.85	$20.36	+/- 7%

Table II.2

Predicted Expense and Confidence Intervals for Services (Acct. 6620)

	FCC Regression Forecast	Confidence Interval Lower 95%	Confidence Interval Upper 95%	Forecast Error %
Expense Assoc. with Switched Access Line	$17.28	$6.02	$28.54	+/- 65%
Expense Assoc. with Special Access Line	$14.06	-$15.38	$43.51	+/- 209%
Weighted Average Access Line Expense	$16.86	$7.26	$26.47	+/- 57%
Expense Assoc. with Toll	$28.26	$18.69	$37.82	+/- 34%
Total Expense	$45.12	$42.75	$47.49	+/- 5%

Table II.3

Predicted Expense and Confidence Intervals

for Corporate Operations (Acct. 6700)

	FCC Regression Forecast	Confidence Interval Lower 95%	Upper 95%	Forecast Error %
Expense Assoc. with Switched Access Line	$34.24	$17.48	$50.99	+/- 49%
Expense Assoc. with Special Access Line	$8.42	-$35.39	$52.24	+/- 520%
Weighted Average Access Line Expense	$30.92	$16.63	$45.22	+/- 46%
Expense Assoc. with Toll	$28.70	$14.47	$42.92	+/- 50%
Total Expense	$59.62	$56.09	$63.14	+/- 6%

Table II.4

Predicted Expense and Confidence Intervals

for Other PP&E (Acct. 6510)

	FCC Regression Forecast	Confidence Interval Lower 95%	Upper 95%	Forecast Error %
Expense Assoc. with Switched Access Line	$0.51	$0.09	$0.94	+/- 83%
Expense Assoc. with Special Access Line	-$0.04	-$1.15	$1.07	+/- 3043%
Weighted Average Access Line Expense	$0.44	$0.08	$0.81	+/- 82%
Expense Assoc. with Toll	-$0.11	-$0.47	$0.25	+/- 328%
Total Expense	$0.33	$0.24	$0.42	+/- 27%

Table II.5

Predicted Expense and Confidence Intervals for Network Operations (Acct. 6530)

	FCC Regression Forecast	Confidence Interval Lower 95%	Upper 95%	Forecast Error %
Expense Assoc. with Switched Access Line	$17.58	$6.78	$28.38	+/- 61%
Expense Assoc. with Special Access Line	$28.82	$0.58	$57.06	+/- 98%
Weighted Average Access Line Expense	$19.02	$9.81	$28.24	+/- 48%
Expense Assoc. with Toll	$15.54	$6.37	$24.71	+/- 59%
Total Expense	$34.57	$32.30	$36.84	+/- 7%

Attachment III

Table III.1

Expense Regression Coefficients Using Split Samples (A and B) for Marketing (Acct. 6610)

Run #	Coefficient of Switched Line *(Full Sample Coeff. = $7.19)* Sample A	Sample B	Coefficient of Special Line *(Full Sample Coeff. = $37.64)* Sample A	Sample B	Coefficient of Toll MOU *(Full Sample Coeff. = $0.0018)* Sample A	Sample B
1	-$0.14	$9.92	$33.12	$41.86	$0.0034	$0.0011
2	$4.63	$8.66	$38.19	$35.59	$0.0023	$0.0015
3	$4.74	$10.32	$42.02	$31.33	$0.0021	$0.0014
4	$7.68	$5.94	$21.00	$51.09	$0.0022	$0.0017
5	$7.49	$7.03	$52.40	$22.67	$0.0012	$0.0023

Table III.2

Expense Regression Coefficients Using Split Samples (A and B) for Services (Acct. 6620)

Run #	Coefficient of Switched Line *(Full Sample Coeff. = $17.28)* Sample A	Sample B	Coefficient of Special Line *(Full Sample Coeff. = $14.06)* Sample A	Sample B	Coefficient of Toll MOU *(Full Sample Coeff. = $0.0063)* Sample A	Sample B
1	$18.72	$15.18	$6.88	$15.49	$0.0066	$0.0063
2	-$1.62	$25.45	-$1.80	$15.06	$0.0109	$0.0044
3	$4.82	$26.83	-$3.95	$25.21	$0.0094	$0.0042
4	$25.09	$15.76	$37.04	-$7.62	$0.0042	$0.0070
5	$18.68	$15.20	$28.49	-$0.15	$0.0057	$0.0071

Table III.3

Expense Regression Coefficients Using Split Samples (A and B) for Corporate Operations (Acct. 6700)

	Coefficient of Switched Line (*Full Sample Coeff. = $34.24*)		Coefficient of Special Line (*Full Sample Coeff. = $8.42*)		Coefficient of Toll MOU (*Full Sample Coeff. = $0.0064*)	
Run #	Sample A	Sample B	Sample A	Sample B	Sample A	Sample B
1	$14.25	$41.68	-$7.68	$30.25	$0.0107	$0.0047
2	$19.47	$46.62	$29.58	-$14.11	$0.0086	$0.0048
3	$19.85	$52.64	$30.72	-$23.59	$0.0084	$0.0039
4	$33.14	$36.08	$10.68	$19.82	$0.0059	$0.0065
5	$14.33	$63.87	$5.05	$7.19	$0.0100	$0.0012

Table III.4

Expense Regression Coefficients Using Split Samples (A and B) for Other PP&E (Acct. 6510)

	Coefficient of Switched Line (*Full Sample Coeff. = $0.51*)		Coefficient of Special Line (*Full Sample Coeff. = -$0.04*)		Coefficient of Toll MOU (*Full Sample Coeff. = $0.00002*)	
Run #	Sample A	Sample B	Sample A	Sample B	Sample A	Sample B
1	$1.17	$0.23	$0.27	-$0.62	-$0.0002	$0.0000
2	$0.86	$0.45	$0.78	-$0.45	-$0.0001	$0.0000
3	$0.95	$0.15	$0.87	-$0.90	-$0.0001	$0.0001
4	$0.70	$0.49	$0.71	-$0.69	-$0.0001	$0.0000
5	$0.95	-$0.12	$0.14	-$0.12	-$0.0001	$0.0001

Table III.5

Expense Regression Coefficients Using Split Samples (A and B) for Network Operations (Acct. 6530)

	Coefficient of Switched Line (*Full Sample Coeff. = $17.58*)		Coefficient of Special Line (*Full Sample Coeff. = $28.82*)		Coefficient of Toll MOU (*Full Sample Coeff. = $0.0035*)	
Run #	Sample A	Sample B	Sample A	Sample B	Sample A	Sample B
1	$25.59	$13.99	$25.31	$39.49	$0.0018	$0.0041
2	$8.09	$19.16	$7.34	$38.43	$0.0064	$0.0026
3	$13.71	$22.06	$24.41	$34.26	$0.0041	$0.0027
4	$34.30	$11.24	$21.25	$34.08	$0.0004	$0.0045
5	$14.38	$22.63	$36.27	$20.40	$0.0037	$0.0029

Attachment IV

Table IV.1
Variable Means for Split Samples (A and B)
for Marketing (Acct. 6610)

	Expense/Total Lines (Full Sample Mean = $18.30)		Sw. Lines/Total Lines (Full Sample Mean = $0.90)		Sp. Lines/Total Lines (Full Sample Mean = $0.10)		Toll MOU/Total Lines (Full Sample Mean = $4,474)	
Run #	Sample A	Sample B	Sample A	Sample B	Sample A	Sample B	Sample A	Sample B
1	$18.53	$18.07	0.89	0.91	0.11	0.09	4,386	4,560
2	$18.28	$18.31	0.89	0.90	0.11	0.10	4,315	4,629
3	$17.92	$18.66	0.89	0.90	0.11	0.10	4,309	4,635
4	$18.97	$17.64	0.89	0.91	0.11	0.09	4,398	4,548
5	$17.41	$19.16	0.90	0.90	0.10	0.10	4,399	4,548

Table IV.2
Variable Means for Split Samples (A and B)
for Services (Acct. 6620)

	Expense/Total Lines (Full Sample Mean = $45.22)		Sw. Lines/Total Lines (Full Sample Mean = $0.90)		Sp. Lines/Total Lines (Full Sample Mean = $0.10)		Toll MOU/Total Lines (Full Sample Mean = $4,474)	
Run #	Sample A	Sample B	Sample A	Sample B	Sample A	Sample B	Sample A	Sample B
1	$46.47	$44.00	0.89	0.91	0.11	0.09	4,386	4,560
2	$45.41	$45.03	0.89	0.90	0.11	0.10	4,315	4,629
3	$44.41	$46.01	0.89	0.90	0.11	0.10	4,309	4,635
4	$44.88	$45.55	0.89	0.91	0.11	0.09	4,398	4,548
5	$44.70	$45.73	0.90	0.90	0.10	0.10	4,399	4,548

Table IV.3
Variable Means for Split Samples (A and B)
for Corporate Operations (Acct. 6700)

	Expense/Total Lines (Full Sample Mean = $60.32)		Sw. Lines/Total Lines (Full Sample Mean = $0.90)		Sp. Lines/Total Lines (Full Sample Mean = $0.10)		Toll MOU/Total Lines (Full Sample Mean = $4,474)	
Run #	Sample A	Sample B	Sample A	Sample B	Sample A	Sample B	Sample A	Sample B
1	$58.65	$61.95	0.89	0.91	0.11	0.09	4,386	4,560
2	$57.61	$62.97	0.89	0.90	0.11	0.10	4,315	4,629
3	$57.31	$63.26	0.89	0.90	0.11	0.10	4,309	4,635
4	$56.46	$64.10	0.89	0.91	0.11	0.09	4,398	4,548
5	$57.31	$63.27	0.90	0.90	0.10	0.10	4,399	4,548

Table IV.4
Variable Means for Split Samples (A and B)
for Other PP&E (Acct. 6510)

	Expense/Total Lines (Full Sample Mean = $0.35)		Sw. Lines/Total Lines (Full Sample Mean = $0.90)		Sp. Lines/Total Lines (Full Sample Mean = $0.10)		Toll MOU/Total Lines (Full Sample Mean = $4,474)	
Run #	Sample A	Sample B	Sample A	Sample B	Sample A	Sample B	Sample A	Sample B
1	$0.41	$0.29	0.89	0.91	0.11	0.09	4,386	4,560
2	$0.30	$0.40	0.89	0.90	0.11	0.10	4,315	4,629
3	$0.40	$0.30	0.89	0.90	0.11	0.10	4,309	4,635
4	$0.34	$0.36	0.89	0.91	0.11	0.09	4,398	4,548
5	$0.39	$0.31	0.90	0.90	0.10	0.10	4,399	4,548

Table IV.5

Variable Means for Split Samples (A and B)

for Network Operations (Acct. 6530)

	Expense/Total Lines (Full Sample Mean = $34.28)		Sw. Lines/Total Lines (Full Sample Mean = $0.90)		Sp. Lines/Total Lines (Full Sample Mean = $0.10)		Toll MOU/Total Lines (Full Sample Mean = $4,474)	
Run #	Sample A	Sample B	Sample A	Sample B	Sample A	Sample B	Sample A	Sample B
1	$33.28	$35.24	0.89	0.91	0.11	0.09	4,386	4,560
2	$35.50	$33.08	0.89	0.90	0.11	0.10	4,315	4,629
3	$32.56	$35.96	0.89	0.90	0.11	0.10	4,309	4,635
4	$34.80	$33.76	0.89	0.91	0.11	0.09	4,398	4,548
5	$32.94	$35.58	0.90	0.90	0.10	0.10	4,399	4,548